The Patent Office

The Patent Office
Cardiff Road
Newport
Gwent
NP9 1RH

#2

PRIORITY DOCUMENT

I, the undersigned, being an officer duly authorised in accordance with Section 62(3) of the Patents and Designs Act 1907, to sign and issue certificates on behalf of the Comptroller-General hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the Patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or the inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Witness my hand this 15th day of MAY. 1991.

W. Russell

COC 1

23 APR 1990

23 APR 90

PATENTS ACT 1977

PATENTS FORM NO. 1/77 (Revised 1982)

(Rules 16, 19)

The Comptroller
The Patent Office

9009073.9

9009073.9

REQUEST FOR GRANT OF A PATENT

THE GRANT OF A PATENT IS REQUESTED BY THE UNDERSIGNED ON THE BASIS OF THE PRESENT APPLICATION

I Applicant's or Agent's reference *(Please insert if available)* JD/MAW/G-1232

II Title of invention "Improvements Relating to the Lining of Pipelines or Passageways"

III Applicant or Applicants *(See note 2)*

Name (First or only applicant) Insituform Group Limited

Country U.K. State ADP Code No. 4450367001

Address 3/4 Hill Street, Douglas, Isle of Man

Name (of second applicant, if more than one) .....

Country ..... State .....

Address .....

IV Inventor (see note 3)

(a) ~~The applicant(s) is/are the sole/joint inventor(s)~~

or

(b) A statement on Patents Form No 7/77 is/will be furnished

V Name of Agent (if any) *(See note 4)* ADP CODE NO

VI Address for Service *(See note 5)*

5 York Place, Leeds LS1 2SD

VII Declaration of Priority *(See note 6)*

Country	Filing date	File number
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

THE PATENT OFFICE
23 APR 1990
RECEIVED BY POST

VIII The Application claims an earlier date under Section 8(3), 12(6), 15(4), or 37(4) *(See note 7)*

Earlier application or patent number ..... and filing date

IX Check List *(To be filled in by applicant or agent)*

A The application contains the following number of sheet(s)		B The application as filed is accompanied by:-	
1 Request	1 Sheet(s)	1 Priority document	.
2 Description	6 Sheet(s)	Translation of priority document	
3 Claim(s)	- Sheet(s)	3 Request for Search	.
4 Drawing(s)	1 Sheet(s)	4 Statement of Inventorship and Right to Grant	to follow
5 Abstract	- Sheet(s)		

X It is suggested that Figure No.....of the drawings (if any) should accompany the abstract when published.

XI Signature *(See note 8)*

NOTES:

1. This form, when completed, should be brought or sent to the Patent Office together with the prescribed fee and two copies of the description of the invention, and of any drawings.

2. Enter the name and address of each applicant. Names of individuals should be indicated in full and the surname or family name should be underlined. The names of all partners in a firm must be given in full. Bodies corporate should be designated by their corporate name and the country of incorporation and, where appropriate, the state of incorporation within that country should be entered where provided. Full corporate details, eg a "corporation organised and existing under the laws of the State of Delaware, United States of America", trading styles, eg "trading as xyz company", nationality, and former names, eg "formerly (known as) ABC Ltd" are *not* required and should *not* be given. Also enter applicant(s) ADP Code No.(if known).

3. Where the applicant or applicants is/are the sole inventor or the joint inventors, the declaration (a) to that effect at IV should be completed, and the alternative statement (b) deleted. If, however, this is not the case the declaration (a) should be struck out and a statement will then be required to be filed upon Patent Form No 7/77.

4. If the applicant has appointed an agent to act on his behalf, the agent's name and the address of his place of business should be indicated in the spaces available at V and VI. Also insert agent's ADP Code No. (if known) in the box provided.

5. An address for service in the United Kingdom to which all documents may be sent must be stated at VI. It is recommended that a telephone number be provided if an agent is not appointed.

6. The declaration of priority at VII should state the date of the previous filing and the country in which it was made and indicate the file number, if available.

7. When an application is made by virtue of section 8(3), 12(6), 15(4) the appropriate section should be identified at VIII and the number of the earlier application or any patent granted thereon identified.

8. Attention is directed to rules 90 and 106 of the Patent Rules 1982.

9. Attention of applicants is drawn to the desirability of avoiding publication of inventions relating to any article, material or device intended or adapted for use in war (Official Secrets Acts, 1911 and 1920). In addition after an application for a patent has been filed at the Patent Office the comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Act and will inform the applicant if such prohibition is necessary.

10. Applicants resident in the United Kingdom are also reminded that, under the provisions of section 23 applications may not be filed abroad without written permission or unless an application has been filed not less than six weeks previously in the United Kingdom for a patent for the same invention and no direction prohibiting publication or communication has been given or any such direction has been received.

Improvements Relating to the Lining of Pipelines or Passageways

This invention relates to the lining of pipelines or passageways, using flexible tubular materials which are impregnated with curable synthetic resin and which, when placed in position lining the pipeline or passageway are held by fluid pressure against the pipeline or passageway surface until the resin cures to a hard condition leaving a hard lining pipe lying on the pipeline or passageway surface.

The most widely practised method using such resin impregnated linings is disclosed in British Patent No. 1449455 from which it will be seen that the impregnated lining is applied to the pipeline or passageway surface by eversion of same into the pipeline or passageway, using fluid pressure.

The present invention is concerned with lining pipelines which are called "laterals" insofar as they enter sidewise a main pipeline or passageway, such as a main sewer. Of any particular main line, there may be a plurality of laterals entering the main line, and it frequently arises that the laterals have to be lined by means of a resin impregnated tube. Using existing methods for lining laterals, it is not possible to perform any lining operation of a second or subsequent lateral whilst the lining in one lateral is being cured. As the cure time may take up to 5 or 6 hours, if a section of main line having say 5 laterals to be lined is involved, the minimum total time to line all laterals will be in the order of 25 to 30 hours. As these lining operations are required to be carried out during the night for purposes of convenience, it is often the case that the completion of the work has to take place over several evenings and therefore the work crew must depart the site and return at a later date to complete the work.

The present invention is concerned with providing an arrangement wherein the completion of a plurality of lateral lining operations may be effected in a much shorter period.

In accordance with the present invention, a plurality of laterals meeting a common main line are lined by inserting resin impregnated linings into said laterals and to hold same in position by fluid pressure whilst curing of the resin takes place, and after insertion of each lining, a seal arrangement at the location where the lateral meets the main line enables the second and subsequent laterals to be lined whilst the first or previously inserted lining is held in position and is being cured.

The seal arrangement may comprise a flexible bag which is pressurised with the medium which urges the lining against the lateral surface so as to prevent escape of the pressurising medium, but such bag allowing pressure fluid supplying pipes to pass to the outside of the bag and to other lateral connections downstream of the bag in the main pipe whereby such other laterals may be lined by the eversion there into of a resin impregnated lining tube, the holding of the lining tube to the lateral surface by fluid pressure, and a sealing bag retaining the lining in position and forming a seal between the lateral and the main line.

It will be seen that by using the method, the linings for the laterals can be inserted sequentially, and held in installed position under pressure, and cured simultaneously. A plurality of laterals can be lined and cured in a total time equal to the time it takes to line one lateral multiplied by the number of laterals plus the curing time for one of the lateral linings which total time in the case of 5 laterals may be in the order of 8 hours, which is a considerable

reduction from the 25-30 hours which are required for the lining of 5 laterals by the conventional method. For example therefore the lateral lining on any particular contract may be capable of being completed in one evening as opposed to being completed in stages over two or three evenings.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, wherein:-

Fig. 1 is a diagrammatic side elevation showing the method by which a lateral is lined in accordance with the method of the invention;

Fig. 2 is a sectional elevation taken on the line II-II;

Fig. 3 is an enlarged sectional view of the detail ringed III in Fig. 1; and

Fig. 4 is an enlarged sectional view of the detail ringed IV in Fig. 1.

Referring to the drawings, in Fig. 1 a main line 10 is intersected by a lateral 12 which is to be lined in accordance with the method of the invention.

For the lining operation, a resin impregnated flexible lining tube 14 has a beaded end 16 which is reinforced, and forms a ring which seats against the opening of the lateral 12. The tube 14 is loaded inside a carrier tube 18. Carrier tube 18 has one end 20 anchored to an elbow pipe 22, and to the other end of the elbow 22 is connected a containment tube 24. a disc 26 seals the other end of the containment tube, but extending through the disc is a pressure hose 28 and a bleed

hose 30.

The pressure hose 28 and bleed hose 30 can slide through the disc 26 as insertion of the lining tube 14 takes place as will be explained.

If reference is made now to Fig. 4, as shown, the tail end of the carrier tube 18 is closed around the bleed hose 30, and the pressure hose 28 is connected to the closed end of the carrier tube 18. The end of the lining tube 14 stops short of the end of the carrier tube so that the lining tube can be left in position lining the lateral 12.

The method of insertion comprises the introduction of pressurising fluid water or gas through the pressure hose 28 into the space between the containment tube 24 and the carrier tube 18 with the result that the carrier tube 18 and the lining tube 14 are everted as shown at 32 in Fig. 1 into the lateral 12, the lining tube 14 being presented to the lateral surface. The assembly of tubes 14 and 18 therefore everts into the lateral 12 and the pressure hose 28 and the bleed hose 30 are pulled through the containment tube, through the elbow 22 and up to the top end of the lateral. The portion 30A of the bleed hose projects out of the end of the eversion phase so that if any water collects above the lining, it can bleed through the end 30A which is provided with apertures 34 for this purpose out of the tube 30 and back to drain so that there will be no undesirable collection of liquid in the lateral whilst lining is taking place.

The pressure fluid which is supplied by the hose 28 leaks through an aperture 36 in the elbow 22 and pressurises a bag or bladder 38 surrounding the elbow as shown. The bladder is therefore inflated so as to seal against the main line 10 and to seal the end 16 of the lining. The bladder 38

remains pressurised as long as the pressure is maintained inside the everted lining and carrier tube. As soon as this position has been reached, a towing assembly 40 which is used for positioning the elbow 22 by being connected thereto through a link 42 is released from that link insofar as, as shown in Fig. 3, the link 42 has a socket 44 in which engages a centralising pin 46. The wall of the socket 44 has aligned apertures 48, 50 in which pegs 52 and 54 engage, these pegs being carried by pivotable jaws 56 and 58. The jaws 56 and 58 are connected to the clamping device 60 having swingable arms 62 and 64 on the ends of which are provided guide rollers 66 and 68. As the bladder 38 inflates, the rollers 66 which are held inwardly by spring action are caused to pivot to the position shown in Fig. 1 which has the effect of moving the jaws 56 and 58 apart to remove the pegs 52 and 54 from the apertures 48 and 50 and the positioning device 40 and the device 60 with the rollers and jaws can be detached from the bladder and the connecting tube 42 so that it can be pulled along the line 10 away from the inflated bladder.

A series of additional pressure pipes 70, 72 (four in all) extend to the outside of the bladder 38 and are removably attached to the positioning device 40. Device 40 is moved to the other end of the main line 10 and a second assembly comprising elbow 22, bladder 38, containment tube 24, sealing disc 26 and the carrier tube and lining 18 and 14 with bladder 38 is connected to the positioning device which is again moved back into the main line 10 until the next lateral to be lined is reached when the device is placed in register therewith so that by appropriate pressurising of the assembly as described in relation to Fig. 1, the lining tube can be inserted into position in the lateral. When this process has been completed, the procedure is again repeated so that all five laterals can have lining tubes placed therein and

the lining tubes can be cured simultaneously.

To effect the curing, it may be necessary to circulate hot water, steam or hot air through the pressurising hoses 28, 70 and 72 if the resin is of the heat cure type.

When curing has been completed, it is simply a matter of releasing the pressure in each of the bladders 38 which will then collapse, and each can be removed from the main line 10 by pulling on the pressure hose 28, 70 or 72 as the case may be. The retraction of such hose retracts the carrier tube 18 from inside the lateral, leaving the rigid lining tube 14 in position.

The present invvention provides a system whereby a plurality of lateral linings may be cured simultaneously thereby reducing the overall cure time in a contract where a number of laterals have to be lined.